Claims

We claim:

1. A system for characterizing multiple power-supply circuits, comprising:

a computer for characterizing energy attributes of a circuit that includes a cell, wherein the cell couples to a plurality of power supplies and has one or more outputs that drive, respectively, one or more loads, the computer configured to:

characterize, according to a model of an operation of the circuit, a dynamic energy attribute of each of the plurality of the power supplies;

characterize, according to the model of the operation of the circuit, a dynamic energy attribute of the one or more loads;

calculate an overall dynamic energy attribute for the plurality of power supplies by summing together the dynamic energy attributes of the plurality of the power supplies;

determine an overall dynamic energy attribute for the one or more loads by adding together the dynamic energy attributes of the one or more loads; and

compute a dynamic energy attribute of the cell by subtracting the overall dynamic energy attribute for the one or more loads from the overall dynamic energy attribute of the plurality of power supplies.

2. The system of claim 1, wherein the computer is further configured to characterize the dynamic energy attribute of each of the plurality of the power supplies by multiplying a voltage across the respective power supply by a charge flowing through the respective power supply.

3. The system of claim 2, wherein each of the one or more loads comprises a substantially capacitive load.

4. The system of claim 3, wherein each of the one or more loads comprises an effective input capacitance of a circuit coupled to the respective output of the cell.

5. The circuit characterization system of claim 4, wherein each of the one or more loads further comprises a capacitance of an interconnect structure coupled to the respective output of the cell.

6. The circuit characterization system of claim 5, wherein the computer is further configured to characterize the dynamic energy attribute of each of the one or more loads by multiplying one half of the respective capacitance of the load by a square of a voltage across the load.

7. The circuit characterization system of claim 6, wherein the computer is further configured to characterize the respective charge flow of each of the plurality of the power supplies by integrating with respect to time a current flowing through the power supply.

8. The circuit characterization system of claim 7, wherein the computer is further configured to characterize, according to a model of an operation of the circuit, a static power attribute of each of the plurality of power supplies by multiplying the current flowing through the respective power supply by the voltage across the respective power supply.

9. The circuit characterization system of claim 8, wherein the cell includes complementary metal oxide semiconductor circuitry.

10. The circuit characterization system of claim 8, wherein the circuit includes at least one positive power supply and at least one negative power supply.

11. A computer program product, comprising:

a computer application, adapted for processing by a computer to characterize energy attributes of a circuit that includes a cell, wherein the cell couples to a plurality of power supplies and has one or more outputs that drive, respectively, one or more loads, the computer application causing the computer to:

characterize, according to a model of an operation of the circuit, a dynamic energy attribute of each of the plurality of the power supplies;

characterize, according to the model of the operation of the circuit, a dynamic energy attribute of the one or more loads;

calculate an overall dynamic energy attribute for the plurality of power supplies by summing together the dynamic energy attributes of the plurality of the power supplies;

determine an overall dynamic energy attribute for the one or more loads by adding together the dynamic energy attributes of the one or more loads; and

compute a dynamic energy attribute of the cell by subtracting the overall dynamic energy attribute for the one or more loads from the overall dynamic energy attribute of the plurality of power supplies.

12. The computer program product of claim 11, wherein the computer application further causes the computer to characterize the dynamic energy attribute of each of the plurality of the power supplies by multiplying a voltage across the respective power supply by a charge flowing through the respective power supply.

13. The computer program product of claim 12, wherein each of the one or more loads comprises a substantially capacitive load.

14. The computer program product of claim 13, wherein each of the one or more loads comprises an effective input capacitance of a circuit coupled to the respective output of the cell.

15. The computer program product of claim 14, wherein each of the one or more loads further comprises a capacitance of an interconnect structure coupled to the respective output of the cell.

16. The computer program product of claim 15, wherein the computer application further causes the computer to characterize the dynamic energy attribute of each of the one or more loads by multiplying one half of the respective capacitance of the load by a square of a voltage across the load.

17. The computer program product of claim 16, wherein the computer application further causes the computer to characterize the respective charge flow of each of the plurality of the power supplies by integrating with respect to time a current flowing through the power supply.

18. The computer program product of claim 17, wherein the computer application further causes the computer to characterize, according to a model of an operation of the circuit, a static power attribute of each of the plurality of power supplies by multiplying the current flowing through the respective power supply by the voltage across the respective power supply.

19. The computer program product of claim 18, wherein the cell includes complementary metal oxide semiconductor circuitry.

20. The computer program product of claim 18, wherein the circuit includes at least one positive power supply and at least one negative power supply.

21. A method of characterizing a circuit that includes a cell, wherein the cell couples to a plurality of power supplies and has one or more outputs that drive, respectively, one or more loads, the method comprising:

characterizing, according to a model of an operation of the circuit, a dynamic energy attribute of each of the plurality of the power supplies;

characterizing, according to the model of the operation of the circuit, a dynamic energy attribute of the one or more loads;

calculating an overall dynamic energy attribute for the plurality of power supplies by summing together the dynamic energy attributes of the plurality of the power supplies;

determining an overall dynamic energy attribute for the one or more loads by adding together the dynamic energy attributes of the one or more loads; and

computing a dynamic energy attribute of the cell by subtracting the overall dynamic energy attribute for the one or more loads from the overall dynamic energy attribute of the plurality of power supplies.

22. The method of claim 21, wherein characterizing the dynamic energy attribute of each of the plurality of the power supplies comprises multiplying a voltage across the respective power supply by a charge flowing through the respective power supply.

23. The method of claim 22, wherein each of the one or more loads comprises a substantially capacitive load.

24. The method of claim 23, wherein each of the one or more loads comprises an effective input capacitance of a circuit coupled to the respective output of the cell.

25. The method of claim 24, wherein each of the one or more loads further comprises a capacitance of an interconnect structure coupled to the respective output of the cell.

26. The method of claim 25, wherein characterizing the dynamic energy attribute of each of the one or more loads comprises multiplying one half of the respective capacitance of the load by a square of a voltage across the load.

27. The method of claim 26, wherein characterizing the respective charge flow of each of the plurality of the power supplies comprises integrating with respect to time a current flowing through the power supply.

28. The method of claim 27, which further includes characterizing, according to a model of an operation of the circuit, a static power attribute of each of the plurality of power supplies by multiplying the current flowing through the respective power supply by the voltage across the respective power supply.

29. The method of claim 28, wherein the cell includes complementary metal oxide semiconductor circuitry.

30. The method of claim 28, wherein the circuit includes at least one positive power supply and at least one negative power supply.